origin. And yet, why it should prefer to make the snow its habitat, or how it can find its way into those regions of frost and infertility, remains a question which still perplexes the naturalist and philosopher.

THE SISCO OF LAKE TIPPECANOE.

BY PROF. D. S. JORDAN.

A SHORT time since, I received from Prof. E. T. Cox, state geologist of Indiana, a collection of deep-water "Siscoes" taken in Lake Tippecanoe, Kosciusko Co., Indiana, by Judge J. H. Carpenter of Warsaw. Prof. Cox requested me to examine these fishes, and prepare an account of their characters and relationship, as considerable interest is attached to them as well as to the fauna in general of the "bottomless lakes" of northern Indiana.

I find them to be Salmonoids belonging to the genus Argyrosomus of Agassiz, a group closely allied to the white fishes (Coregonus) but distinguished by the greater development of the lower jaw, which usually projects decidedly beyond the upper, the reverse being true of Coregonus. The maxillary bones are rather longer, and the bones of the mandible rather heavier, and the teeth although very feeble are slightly stronger than in Coregonus. Compared with Coregonus most of the species have a more slender form; hence their popular name of "lake herrings," although their resemblance to the sea herring is quite superficial.

This Indiana Argyrosomus appears to be quite distinct from the species found in Lake Michigan; *i. e.*, the shallow-water "herring" (*A. clupeiformis* Mitch.) and the deep-water "moon eye" (*A. Hoyi* Gill) and "black fin" (*A. nigripennis* Gill), and it is presumably different from *A. harengus* (Rich.) and *A. lucidus* (Rich.), which, if really distinct species, seem to be loose-scaled, shallow-water fishes, allied to *A. clupeiformis*.

It seems to be identical with the "Sisco" of the deep lakes of southern Wisconsin, a fish, which, although known for some time to naturalists, has not yet, as far as I am able to ascertain, received any specific name.

I have therefore ventured to describe these fishes as new, under

the name *Argyrosomus Sisco*,[1] taking as the type of the species several specimens — male and female — from Lake Tippecanoe, caught in the spawning season, about Nov. 25, 1874. Comparisons with *A. Hoyi* and other related species are made below. I am indebted to Dr. Hoy for specimens of *A. Hoyi* and the Wisconsin "Sisco," and for the opinion that the latter is entirely distinct from *A. nigripennis*, a species which I have been unable to obtain.

This fish has been found in Geneva Lake in Walworth Co., Lake Mendota in Dane Co., and, I think, in Lake Koshkonong. It should be noticed that these lakes belong to different water systems, Geneva Lake being drained by Fox River, a tributary of the Illinois, Lake Mendota by Cat-fish River, a branch of Rock

---

[1] ARGYROSOMUS SISCO Jordan.—Form regular, spindle-shaped, compressed, slightly elevated at the beginning of the dorsal fin; general outline not very different from others in the genus.

The greatest depth of the body is contained 4 1-10 times (4 1-4 in males, 4 1-2 in *A. Hoyi)*, in length from tip of snout to the end of the scales at base of caudal. The thickness of the body is about half its depth. The head is moderate, pointed, compressed and depressed. The skull is flattish above, with a longitudinal ridge. The interorbital space is slightly wider than the eye. The length of the head is less than the height of the body (nearly equal in males), and is contained 4 1-2 times (4 1-3 to 5; 4 in *A. Hoyi*) in length of body exclusive of caudal. The eyes are large and circular, and their diameter is contained 3 3-5 (3 1-2 to 3 3-4; 3 1-2 in *A. Hoyi)* times in the length of the side of the head. The nostrils are large, nearly midway between eye and tip of snout, and on the upper surface of the head.

The opening of the mouth is rather small and quadrangular. The lower jaw is longer than the upper, rather less so than in *A. clupeiformis*, very much more so than in *A. Hoyi*, which is almost Coregonus-like in this respect. A slight elevation at the tip of the lower jaw, suggesting the "nail" on the bill of ducks, overlaps and fits into a slight emargination at the end of the upper jaw. Margins of lower jaw with slight roughnesses representing teeth. Intermaxillaries with minute asperities. Tongue provided with minute teeth which however are readily evident.

Maxillaries rather strong, weaker than in *A. Hoyi*, contained 3 1-3 (2 3-4 in *A. Hoyi)* times in side of head, not reaching a vertical line through the centre of the eye.

Length of mandible much more than least depth of tail. 2 1-8 (2 in *A. Hoyi)* times in head. General characters of opercular bones, branchial openings and branchiostegals as in other species.

Distance from occiput to tip of snout contained 2 1-3 times (1 7-8 in *A. Hoyi)* in distance from occiput to beginning of dorsal. Depth of head at occiput 2-3 the length of the side of head.

The scales are relatively smaller than in most of the other species, the lateral line having 84 developed scales (81 to 86; 75 in *A. Hoyi*, 73 in a specimen of *A. clupeiformis)* besides several small ones at the base of the caudal, which form a concave margin somewhat parallel with the fork of the fin, as in other species.

The scales, though thin, are quite firm, rather less so than in *A. Hoyi*, very much more so than in the "Lake Herring."

The lateral line is very evident, nearly straight, and rather nearer the back than belly. There are eight series of scales between the lateral line and the ventrals.

The radial formula is D. II, 9 or 10, P. 15, V. 12, A. I, 12.

The dorsal fin begins in front of the ventrals at a point about equidistant between the front margin of the eye and the first rays of caudal. It is short and rather high;

River, while Lake Tippecanoe is one of the sources of Tippecanoe River, which flows into the Wabash. I have not heard of these fishes in Lake Winnebago or any water flowing into Lake Michigan. In Lakes Winnebago and Buttes des Morts the name "Sisco" has been transferred to the common white lake bass (*Roccus chrysops* Gill).

Concerning the habits of the Indiana Sisco, we have the following information from Judge Carpenter:

"Some years ago, probably five, these fish were discovered on the north side of Tippecanoe Lake by Isaac Johnson, and at each return of their spawning season, which is in the last of November, they have reappeared in large numbers. They are not seen at any other season of the year, keeping themselves in the deep water

---

its greatest height is a little more than 2-3 the length of the head. Its length is 2-3 of its greatest height. Its longest ray is a little more than 3 times the length of the shortest, thus giving the fish a different form from *A. Hoyi*, in which the longest ray of the dorsal is nearly 4 times the length of the shortest. The adipose fin is rather slender and reaches slightly beyond the termination of the anal.

The pectorals are rather long and pointed, about as long as the ventrals and of course not reaching nearly to them.

The ventrals are rather large, more than 2-3 the length of the head, falling considerably short of vent. The accessory scale at their base is rather short and triangular, less than half the length of the fin. The depth of the body at the vent is contained 5 3-4 (6 3-4 in *A. Hoyi*) times in the length of the body.

The caudal fin is deeply forked, its lobes are long and pointed, but in all my specimens more or less mutilated. The distance from the vent to the rudimentary caudal rays is contained 4 3-5 (4 1-2 in *A. Hoyi*) in the length of the fish.

The color (from fresh specimens), deep steel-blue above becoming gradually paler to below the lateral line, where it changes to silvery. The arrangement of the scales gives an appearance of longitudinal lines which are conspicuous in certain lights.

All the scales except those of the belly are finely dotted with black, except on their free margins, which being transparent, show the dots on the scales below.

Vertical fins and tips of paired fins also thickly punctate, as well as the skin of the head, particularly above and on the maxillaries and suborbitals.

These black dots seem to be of specific importance as they occur in both Wisconsin and Indiana specimens. They are not noticeable on *A. Hoyi*, excepting on the head. The latter is a more brilliantly colored fish, its scales having a peculiar rich silvery lustre wanting in the Sisco.

Average length of specimens examined, 9 1-2 inches, including the caudal fin, being thus larger than *A. Hoyi*, which rarely exceeds 7. The largest specimen of the Sisco seen measures 10 1-2 inches. Larger individuals sometimes occur. Mr. Carpenter writes that "occasionally one is caught weighing 1 1-2 to 2 pounds, but it is very unusual to find them so large."

The single specimen in my possession of the Wisconsin Sisco agrees in the main with the above, but it is a slimmer fish (perhaps owing to sex or season), the depth being contained 5 times in the length of the body, the head 4 2-3 and the eye 4 times in the head. The maxillary is longer, 2 7-8 in length of head, the depth at the vent 6 3-4 in the length of the body, and the distance from vent to base of caudal only 4 times. The scales are obviously larger, there being but 77 in the course of the lateral line. To how much weight these differences are entitled can only be told by a comparison of a number of specimens.

of the lakes. The general opinion is that they will not bite at a hook, but Mr. Johnson says that he has on one or two occasions caught them with a hook. To my knowledge they have never been found in but two of our lakes, Tippecanoe and Barber's, which are both large lakes and close together, as will be seen by reference to the map.

The spawning season lasts about two weeks and they come in myriads into the streams which enter the lakes. There are large numbers of persons who are engaged night and day taking them with small dip nets. They are caught in quantities that would surprise you, could you witness it. Those who live in the neighborhood put up large quantities of them, they being the only fish caught in the lakes that will bear salting. Some gentlemen who have been fishing to-day (Dec. 8) inform me that the run is abating and that in a few days the fishes will have taken their departure for the deep water of the lakes, and will be seen no more until next November."

As far as I can learn, the habits of the Wisconsin Sisco are similar, but they seem to be much less abundant. Fishermen say that specimens were once sent to Prof. Agassiz, who pronounced them something "new and extremely rare." Specimens procured for me last year, by Prof. Copeland, cost a dollar apiece of the fisherman, which shows the high value attached to these fishes, as *A. clupeiformis* when taken from the nets is not worth more than ten cents a dozen.

Concerning the Lake Michigan species Dr. Hoy writes me, "*A. nigripennis* is a large, magnificent fish. It can be known at once by the black fins. It is never caught in less than 60 fathoms, and not in large numbers till you reach a depth of 70 fathoms. The *A. Hoyi* is the smallest of the Salmonidæ, if I am not mistaken. It never approaches the shoal water, where *A. Artedi* (= *A. clupeiformis*) is only found. About 30 or 40 fathoms is as near shore as it has ever been captured here."